ever undertake such a task, he must bear one thing well in mind, and that he must not do not do it with the view of "exploding" any one's "peculiar notions," but rather with the view of getting at the truth of the matter. Then, too, do not condemn another's views simply because "leading authorities on avian anatomy are overwhelmingly if not unanimously against his side of the question (p. 1040)." That has been the case with a great many anatomists in the world's history, and even I can remember when the "leading authorities" overwhelmingly if not unanimously believed that *Chamœa* was a *Wren;* but the present writer in his published account[5] based upon his "extensive dissections" claimed it was most nearly related to the Bush-Tits (of the genus *Psaltriparus*), to which opinion the "leading authorities," who have reviewed my work, are now rapidly coming. But no doubt Mr. Ridgway remembers something of this; he most assuredly does if he is familiar with the literature we have upon the subject.

R. W. Shufeldt.

Animal Coloration.[6]—This volume has grown out of materials collected by Mr. Beddard for the Davis lectures delivered at the Zoological Garden of London in 1890. It contains the latest information as to the phenomena of coloration exhibited by animals, together with the most important theories upon the subject, including those of Dr. Eisig and M. Stolzmann, which had not previously found their way into works of a popular character. Mr. Beddard groups his facts under the following heads: Coloration Affected by Environment; Protective Coloration; Warning Coloration; Protective Mimicry; Sexual Coloration.

In summarizing the facts concerning Protective Mimicry, the author concludes that the theory of Natural Selection alone does not satisfactorily explain the remarkable resemblances included under that caption.

The chapter on Sexual Coloration calls attention to some objections to Darwin's theory of sexual selection, and gives briefly a sketch of the views of Mr. Stolzmann and those of Mr. Wallace.

Mr. Beddard's objections to the use to which the theory of Natural Selection has been put by various naturalists, and especially by Messrs

[5] "On the Position of Chamæa in the System." The Jour. of Morph., Vol. iii, No. 3, pp. 475–502, figs. 1–8.

[6] Animal Coloration, an Account of the Principal Facts and Theories Relating to the Colors and Markings of Animals, by Frank E. Beddard, M. A. Oxon., F. R. S. E., with four colored plates and wood cuts in the text. London, Swan, Sonnenschein & Co.; New York, Macmillan & Co., 1892.

Wallace and Poulton, are well taken. While he is far from denying the efficacy of that process, he does not trace to it the origin of characters, and he presents various instances where the latter seem to have been the consequence of the direct action of physical causes. His investigations are especially valuable because they cover a field which has been especially cultivated by the advocates of the exclusive efficiency of natural selection, and he thus throws new light on the class of facts where the evidence for natural selection is strongest. For this reason the work will well repay perusal, as it serves as a corrective to thought which has, in the opinion of many, gone to an extreme in one direction.

FIG. 1. The Stoat in winter pelage, or Ermine.

The author cites the following remarkable example of the direct effect of physical causes in producing changes of coloration:

"That the yellow color of canaries can be altered to an orange red by mixing cayenne pepper with their food has been known for a long time. This curious fact was first discovered in England, as was also the fact that the different races of canaries vary in their susceptibility to the action of the pepper; some kinds are more, others are less affected, while one race is absolutely without any power of having its coloration altered by these means. The color change is produced by feeding the newly hatched young with the pepper conveyed in their food or the old birds while sitting upon the nest are furnished with food containing the cayenne, which they in turn feed their offspring. The color change can, in fact, be only brought about in very young

birds whose feathers are not completely matured; it is quite impossible to produce any alteration upon the full grown canary. Clearly, therefore, here is an instance of the direct effect of food upon color. An interesting paper upon the subject, which has also furnished me with the facts already mentioned,[2] and it will be of interest to give some account of the author's (Dr. Sauermann's) experiments for reasons that will appear. Cayenne pepper, of course, is a composite substance, from which a number of distinct chemical substances can be extracted; the red color is caused by a pigment termed capsicin, which can be separated from the pepper; and it might easily be supposed that the change from yellow to red in the feathers of the canary was simply caused by a transference of the pigment, as in the cases mentioned on p. 127; but Dr. Sauermann shows that it is not so. Yellow colored canaries were not in the very slightest degree affected by the pigment alone; but, curiously enough, parti-colored birds did react—the brown parts of the feathers became distinctly lighter in hue. It is a fatty substance (triolein) which appears to convey the pigment and produce thus a changing of the color from yellow to red; and further experiments were made with other birds, showing that it is not only canaries which are influenced by their food in this way. Some white fowls, belonging to a special breed, showed traces of yellow among the feathers after feeding with cayenne; but in this case these were not racial, but individual differences in susceptibility, for all the specimens of birds experimented with did not react to the stimulus.

"A similar series of experiments was made with some other colors; it was found with carmine that the yellow color was destroyed and the birds became white. This unexpected effect is explained by the fact that a mixture of violet and yellow produces white. The fact that the fatty constituent, triolein, plays the chief part in the coloring of the feathers may perhaps help to explain the very singular fact that the Amazon parrots change from green to yellow when fed upon the fat of certain fishes.

"With regard to the white fowls referred to, the experiments made by Dr. Sauermann were particularly interesting. The interest lies in the fact that the pigment was not absorbed equally by all the feathers; only special tracts were affected; the breast feathers, for instance, became red, while the head remained white. It is therefore quite credible that in a state of nature partial alteration of color may be produced by a change of diet."

[2]Archiv. Anatomie und Physiol., 1889. Physiol., Abtheil., 543.

In a chapter relating to protective resemblances will be found an account of several examples of animals which have apparently acquired a resemblance to their surroundings by the transference of pigment to their bodies in their food.

The list of illustrations comprises four very attractive colored plates and thirty-six wood cuts, each of which repay study.

We reproduce three of these; one that represents color harmony

FIG. 2.
The Polytmus humming bird; lower figure the male; the upper the female.

FIG. 3.
The male argus pheasant.

with the environment in the winter pelage of the stoats; and two showing similar feather developments in the tails of the Polytmus humming bird and of the Argus pheasant, in America and Asia respectively.